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THESIS

**LOGISTICS SUPPORT FOR A
NONDEVELOPMENTAL ITEM: A CASE STUDY
OF THE PORTABLE HYDRAULIC ACCESS
RESCUE SYSTEM (PHARS)**

by

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March, 1996

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(PHARS)**

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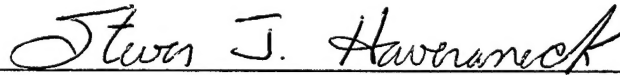
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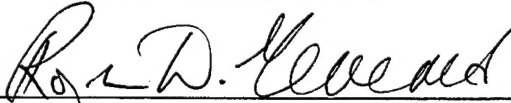
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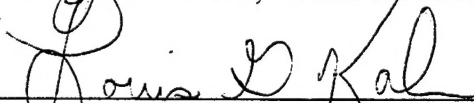


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ABSTRACT

The purpose of this thesis is to compare the cost effectiveness of alternative methods of providing logistics support for commercially available products purchased by the Government. These products will be referred to under the generic title of nondevelopmental items. The thesis focuses on the acquisition and support strategies for the Portable Hydraulic Access Rescue System (PHARS) as a means of addressing this issue. The effectiveness of alternative methods used to provide logistic support for the PHARS is examined via a cost-benefit analysis. The analysis indicates that nondevelopmental items with system wide applications, low failure rates, high urgency of need, mid-range cost, and well established geographically diverse contractors may best be supported via a mix of contractor and organic support. This analysis may be of value to future program managers in assisting their decision on types and levels of support to be provided to other nondevelopmental items.

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I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DOD) in 1996 finds itself in a uniquely challenging situation. Round after round of budget cuts have not been matched by reduced operational requirements. This is resulting in DOD finding itself under unparalleled pressure to be both effective and efficient. This pressure is quantified in a vast array of statutory and regulatory guidance. As one means of addressing the issue, DOD has embraced the concept of fulfilling procurement requirements via nondevelopmental items.

At first glance nondevelopmental items appear to offer the ideal solution to the challenge. They are able to offer state of the art technological capabilities combined with an initial lower life cycle cost. Additionally, they can be introduced more quickly than traditional developmental systems. Nondevelopmental items foster competition by widening the range of defense contractors that are able to do business with the DOD. They also encourage entrepreneurs to bear research and development costs that would otherwise fall upon the government.

Many programs are rushing to reap the benefits of a nondevelopmental item acquisition. The problem with this scenario is that in their rush they may be failing to consider

the most cost effective method of providing logistics support for that item. Given the increasing emphasis on this type of procurement, the importance of examining methods to accomplish it in a successful and long term cost effective fashion cannot be overstated.

B. OBJECTIVE

The objective of this thesis is to compare the cost effectiveness of alternative methods of providing logistic support for a nondevelopmental item. It will entail examining in detail the procurement of the Portable Hydraulic Access Rescue System (PHARS), also known as the "Jaws of Life." The intent will be not only to determine the optimal support strategy for the PHARS but also to extrapolate the data from the PHARS to provide decision makers with a framework for analyzing logistic support strategies for other nondevelopmental items of a similar nature.

C. RESEARCH QUESTIONS

1. Primary Research Question

- Are there more cost effective methods of providing logistics support for the PHARS?

2. Subsidiary Research Questions

- What are the advantages and disadvantages in a nondevelopmental item acquisition?

- What are the primary logistic support strategies used by DOD for nondevelopmental items?
- What form of logistic support was intended at the outset of the PHARS procurement and what was the impact of that choice?
- What form of logistic support is currently provided for the PHARS?
- Are there ways to improve the cost effectiveness of logistic support for NDIs similar to the PHARS?

D. SCOPE OF THESIS

This thesis will focus on logistic support strategies and alternatives for the PHARS. In order to establish a framework for this it will be necessary to examine the primary logistic support strategies used by DOD to support nondevelopmental items. Comparisons will then be made as to the cost effectiveness, potential benefits, alternatives and long range ramifications of each method. The potential for extending the data from the PHARS to other similar nondevelopmental items will be explored.

E. METHODOLOGY

Data on nondevelopmental items, their history and methods of support will be obtained via an archival based method focusing on legislation, government reports and military instructions. Data on the PHARS will be obtained through manufacturers and Government documents, as well as personal interviews with the manufacturers technical representatives.

Data on the PHARS procurement will be obtained through contractual documents and interviews with key decision makers at Naval Sea Systems Command (NAVSEA), Navy Inventory Control Point (NAVICP) and the Secretary of the Navy's Safety and Survivability Office. A survey will be used to determine fleet response to the support provided the PHARS at the Supply Officer and Damage Control Assistant (DCA) level.

The data will then be analyzed to determine the cost and level of operator satisfaction with the current support strategy for the PHARS. This cost and level of satisfaction will then be examined via cost benefit analysis with projections of costs and levels of satisfaction provided by alternative support measures for the PHARS. Recommendations will be made regarding the programs effectiveness, the supportability and utility of the item and the optimal support strategy.

F. ABBREVIATIONS

A list of abbreviations and acronyms may be found in Appendix A.

G. ORGANIZATION

This thesis is organized into six chapters. Chapter I has served as the introduction. Chapter II will provide an overview of nondevelopmental items, a definition for them, their history, pertinent policy, methods of support and

inherent advantages and disadvantages. Chapter III will cover the PHARS, its acquisition history, support philosophy, current method of support and performance to date. Chapter IV will provide an examination of current logistic support issues facing the PHARS program today. Chapter V will be a cost benefit analysis of the data presented in Chapter III and IV with respect to the options presented in Chapter II. Chapter VI will be composed of a summary of the information presented in the first five chapters as well as conclusions and recommendations.

II. NONDEVELOPMENTAL ITEMS: AN HISTORICAL PERSPECTIVE

A. INTRODUCTION

This chapter will provide the background information and theoretical framework necessary to the discussion of methods of logistic support for a nondevelopmental item. The chapter will begin by defining what a nondevelopmental item is and examining the history of the nondevelopmental item movement in DOD. This will be followed by an overview of the DOD acquisition process with respect to both developmental and nondevelopmental items. Next will be a review of the primary advantages and disadvantages associated with a nondevelopmental item procurement. Finally the chapter will examine the primary methods of providing logistic support for a nondevelopmental item and the relative strengths and weaknesses of each approach.

B. DEFINITION OF A NONDEVELOPMENTAL ITEM

There are a range of definitions available to describe just what exactly a nondevelopmental item is. It seems that each level of government, from Congress on down, has published its own definition of a nondevelopmental item. A broad definition of is provided by the Defense Systems Management College which defines nondevelopmental item as: "a term covering material available from a range of sources with little or no developmental effort required by the

Government." [Ref. 1:p. 3]

A more thorough description is provided by Department of Defense Instruction (DODI) 5000.2, which defines nondevelopmental items as:

1. Any item available in the commercial marketplace.
2. Any previously developed item in use by a Federal, State, or local Agency of the United States or a foreign government with which the United States has a mutual defense cooperation agreement.
3. Any item described in subparagraph 1 or 2 that requires only minor modification to meet the requirements of the procuring agency.
4. Any item currently being produced that does not meet the requirements of subparagraph 1, 2, or 3 solely because the item is not yet in use or is not yet available in the commercial marketplace. [Ref. 2:p. 6-L-1]

C. HISTORICAL PERSPECTIVE

The roots of the non-developmental item movement can be traced back at least as far as 1972 when the Commission on Government Procurement acknowledged the need for a philosophical shift in the government's acquisition policies. The focus of the shift was intended to be away from developmental items and towards the commercial marketplace. [Ref. 3:p. 1-1]

This movement received an enormous boost in June of 1986 when President Reagan's Blue Ribbon Commission on Defense Management, also known as the Packard Commission, issued its final Report. Amidst a host of sweeping suggestions for change the Commission came out strongly in favor of non-

developmental items by specifically recommending that:

Rather than relying on excessively rigid military specifications, DOD should make greater use of components, systems and services available off-the-shelf. It should develop new or custom made items only when it has been established that those readily available are clearly inadequate to meet military requirements. [Ref. 4:p. 60]

The United States Congress apparently took these recommendations to heart and gave them the force of law with the passage of the 1987 Defense Appropriations Act. Included in Section 907 of Public Law 99-591 is a statutory preference for the DOD to use nondevelopmental items. The law specifically states that:

The Secretary of Defense shall ensure to the maximum extent practicable--

(1) Requirements of the DOD with response to a procurement of supplies are stated in terms of--

- (a) functions to be performed
- (b) performance required
- (c) essential physical characteristics

(2) Such requirements are defined so that nondevelopmental items may be procured to fulfill such requirements: and

(3) such requirements are fulfilled through the use of non-developmental items. [Ref. 5]

In 1991 DOD took additional steps to ensure compliance with the law. Both DOD Directives 5000.1 and 5000.2 included specific instructions with respect to the acquisition of non-developmental items. DOD 5000.1 states that:

Maximum practicable use shall be made of commercial

and other non-developmental items. In describing these items maximum practicable use shall be made of non-government standards and commercial item description. [Ref. 6:p. 1-4]

DOD Directive 5000.2 provides further amplification in the statement that:

"Material requirements shall be satisfied to the maximum extent practicable through the use of nondevelopmental items when such products will meet the user's needs and are cost-effective over the entire life cycle." [Ref. 2:p. 6-L-2]

It is noteworthy that DOD Directive 5000.2, while acknowledging the significance of cost effectiveness, fails to provide any criteria by which to determine it.

The most recent policy on the use of non-developmental items is contained in the 1993 National Performance Review. The review, chaired by Vice President Gore, suggests that the government should rely more on the commercial marketplace to fulfill its procurement requirements. Specifically the report recommends that:

The Pentagon make greater use of commercial products and abandon military specifications as much as possible. That Agency Heads review and revise internal policies and procedures to allow for the purchase of commercial products wherever practical and to take advantage of market conditions. That Government procurement as a whole shift from rigid rules to guiding principals that will shift to a new emphasis on choosing best value products and foster competitiveness and commercial practices. [Ref. 7:p. 28-30]

D. THE DOD ACQUISITION PROCESS

The DOD acquisition process for developmental items is an incredibly complex, expensive and time consuming affair. It is

composed of five phases each with its own milestone review. It is described by the Defense Systems Management College as:

The sequence of acquisition activities starting with the agency's reconciliation of its mission needs, with its capabilities, priorities and resources and extending through the introduction of a system into operational use or the otherwise successful achievement of program objectives. [Ref. 16: p. 1.4-5]

The first step in this process is the documentation of a war fighting deficiency. This is accomplished via a document known as the Mission Needs Statement (MNS). The Mission Needs Statement defines the requirement in the broadest possible terms, e.g., prevent an armored formation from advancing 200 kilometers beyond the front lines. [Ref 6: p.2-3]. As the requirement progresses through the acquisition process these broad statements will be continuously refined and detailed in a process known as tailoring.

The next step in the process is Milestone 0. This occurs upon approval of the Mission Needs statement and signifies the beginning of the Concept Exploration and Definition Phase. At this point the Service Component will establish a program office in order to develop, produce and support the system. During this phase the program manager is responsible for evaluating alternative concepts with respect to their life cycle costs, deployment schedules and performance characteristics. This is the point in time where the

utilization of a nondevelopmental item in place of a developmental one should first be considered.

At the conclusion of the Concept Exploration and Definition phase a determination is made as to whether or not the system merits a new acquisition program. If this is determined to be the case the system will then progress into Phase I, Demonstration and Validation.

During the Demonstration and Validation Phase the program manager is responsible for delineating essential design characteristics and capabilities. Additionally critical technologies are demonstrated and processes vital to the concept are proven. Upon completion of this phase the program enters into another review at Milestone II, known as Development Approval. A decision to continue with the program at this point leads to Phase II, Engineering and Manufacturing Development.

Engineering and Manufacturing Development consists of the program manager developing the most promising design into a stable, producible and cost effective system. At the conclusion of this phase a decision is made regarding whether the system merits full production. If it does, the system then moves into Phase III, Production and Deployment.

During Production and Deployment the system is placed in full rate production and fielded to meet the mission requirement. Hopefully, as a result of the exhaustive review process, the system will satisfy the mission requirement and

move directly into the final phase, Phase IV Operations and Support. Should the system require any significant modifications a final milestone, Milestone IV, Major Modification Approval is conducted. This milestone has the potential to take the program all the way back to the beginning of Phase Two!

This process is the framework for all developmental acquisition programs. It is presented, in an extremely abbreviated fashion for purposes of illustration only. A much more detailed treatment may be found in DOD Directive 5000.1 Defense Acquisition, and DOD Instruction 5000.2 Defense Acquisition Management Policies and Procedures. It is noteworthy that on average it takes between 8 and 16 years for a full scale developmental system to make its way through the entire process. [Ref. 14:p. 25]

E. NONDEVELOPMENTAL ITEMS AND THE DOD ACQUISITION PROCESS.

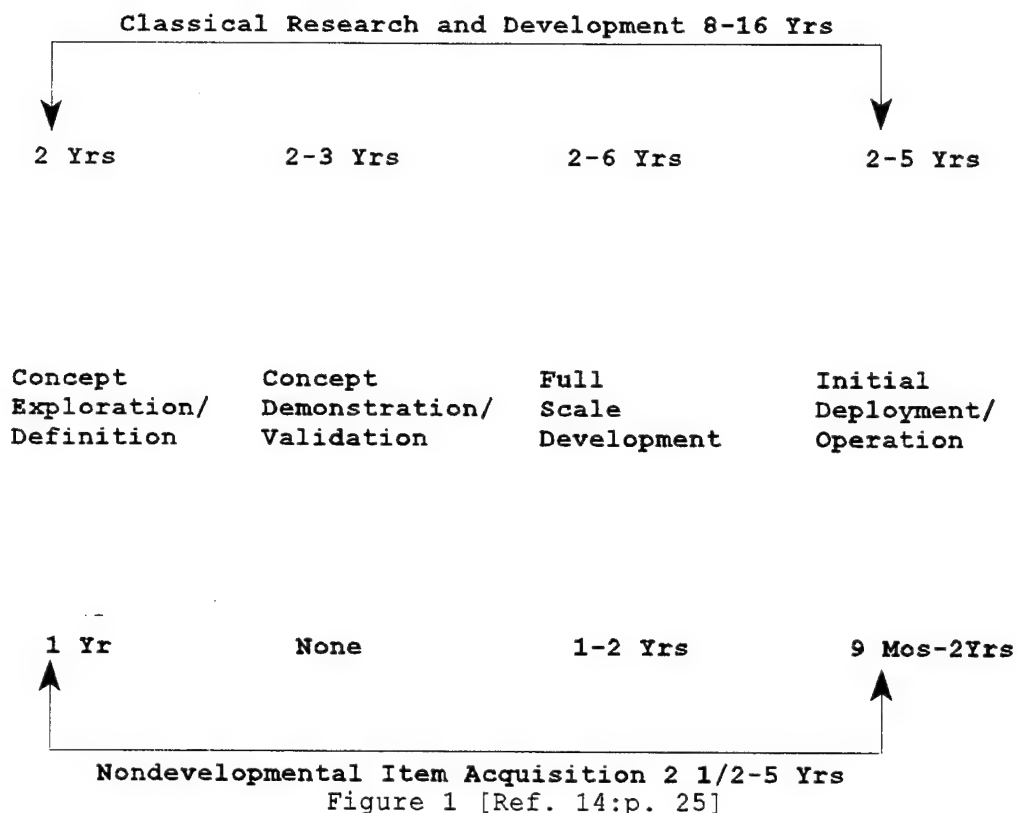
Certainly one of the most attractive features of a nondevelopmental item acquisition is the speed with which the system can be fielded. A nondevelopmental acquisition generally takes between two and one half and five years compared to eight to sixteen for a developmental system. [Ref 14:p. 25]

Nondevelopmental acquisitions are able to save time at virtually ever step of the process. The Demonstration and Validation Phase and the Engineering and Manufacturing Phase,

and their associated costs are borne by the commercial developer. These phases can be eliminated outright or drastically scaled back. This four to nine year cycle can be compressed into a one to two year "Proof of Principal" phase.
[Ref. 14:p. 24]

The speed with which a nondevelopmental system may be fielded is a double edged sword however. The time savings in the acquisition process is roughly the time the system uses to create a logistics support network and training plan for the system. It is important to recognize that while certain costs are avoided, equally tangible benefits are also being forgone.

A comparative illustration of the two processes is provided in Figure 1.



F.ADVANTAGES AND DISADVANTAGES OF NONDEVELOPMENTAL ITEMS

1. Advantages Of Nondevelopmental Items

This list by its nature must be subjective. It is not intended to be all inclusive but rather to offer a range of what the researcher considers to be the primary or most significant advantages and disadvantages inherent in the acquisition of nondevelopmental items.

a. Speed

The compressed acquisition cycle for nondevelopmental items allows DOD to respond more quickly to emergent operational requirements.

b. State-Of-The-Art-Material

Nondevelopmental Items allow DOD to capitalize on state-of-the-art innovations in technology and application. In fields changing as rapidly and dramatically as electronics, computers, optics and communications this can be critical.

c. Risk Reduction

A nondevelopmental item acquisition allows the DOD to minimize risk in the technical and schedule arena of a program by placing the burden of research, test and development on the commercial market place. [Ref. 8:p.1-5]

d. Lower Life Cycle Costs

Nondevelopmental items generally tend to have initially lower life cycle costs due to increased market place competition, reduced research and development costs and the use of commercial specifications. Additionally, a firm off-the-shelf price will allow a program manager to more accurately project funding requirements, reducing variability and enhancing program stability.

e. Maintenance Of The Industrial Base

Expanded demand from the government will serve to broaden and maintain the industrial base. [Ref. 9:p. 10] In an era beset with defense downsizing this is a significant ancillary benefit.

f. Quality

The quality of nondevelopmental items has proven to be as good or better than items specifically developed to meet military requirements. [Ref. 10:p. 5]

g. Simplified Contracting Procedures

Nondevelopmental items are more likely to be procured under a Fixed Price type Contract. These contracts are less complicated to administer and place more of the risk burden on the contractor and less on the Government. [Ref. 11:p. 11]

h. Statutory And Regulatory Compliance

The simple fact is that both the law of the land and DOD Regulation have clearly established a preference for nondevelopmental item acquisitions. Their use will allow the purchasing agency to address some of the issues of waste and inefficiency associated with more traditional forms of procurement.

2. Disadvantages Of Nondevelopmental Items

a. Logistics Support

To date, nondevelopmental item acquisitions in DOD remain the exception rather than the rule. As such they do not fit easily into the rigid and highly structured process DOD Uses to provide logistics support for an item. It is possible for a nondevelopmental item to fail, become unrepairable or even obsolete prior to the first delivery of spare parts onboard a fleet unit. [Ref. 12:p. 20]

Additionally the speed with which a nondevelopmental item may be procured generally precludes any formal type of logistic support analysis or consideration of support requirements. In effect this responsibility is shifted to the developer of the item. This results in increased reliance on the developer for support.

b. Configuration Control and Obsolescence

What some see as advantages in procuring state of the art material, others see as disadvantages in the areas of configuration control and obsolescence. The rapid introduction and discontinuance of high tech products may cause nondevelopmental product configuration to lag behind or become obsolete. In turn, this can serve to make configuration management more difficult. [Ref.13: p.5]

An easy way to illustrate this point is through the

example of the desktop computer. Ten years ago this item was not common at the shipboard level. Today, however, PC's are as common on ships as bad coffee. Unfortunately, as each ship rushed into the commercial marketplace to take advantage of the computer revolution they purchased various brands with different configurations. This process has been repeated as each successive generation of computers has been introduced or as the commands saw turnover in those with purchase authority. The end result has been mishmash of machines with different operating systems, different capabilities, different software and different support requirements. Each ship must carry a range of spare parts to support these unique systems. The lack of commonality makes organic logistic support difficult.

c. Training

The speed with which a nondevelopmental item can be introduced into the system may preclude the development and institution of a conventional training establishment. Clearly the utility of the item is reduced if no one in the organization is familiar with proper operating procedure.

d. Increased Safety Concerns

The move away from military standards (MILSTD) and military specifications (MILSPEC) and into the commercial marketplace has some potentially dire consequences. The rigid performance criteria and extensive testing and documentation

that go into a developed item are counted as a blessing by many who must field, fight or fly the system. The challenge will be to reap the benefits of non-developmental acquisitions without incurring human costs due to equipment that is less exhaustively tested.

G. METHODS OF SUPPORTING NONDEVELOPMENTAL ITEMS

There are four primary approaches used to provide logistic support for a non-developmental item. They are:

(1) No Support. The item is simply discarded upon failure.

(2) Organic Support. The Government develops its own support program to include spares provisioning, a maintenance philosophy and a training plan.

(3) Total Contractor Support. The polar opposite of organic support. The responsibility for spares and maintenance is delegated either contractually or by default to the manufacturer.

(4) Organic and Contractor Support Mix. Combines features from methods two and three. [Ref. 14]

1. No Support

The no support method requires the lowest level of logistics support. Since the item is intended to be discarded upon failure, no repair parts or complex maintenance philosophy are necessary. When the item fails it is replaced by the user with another identical item. Although this approach to support appears to be wasteful, there are important marginal cost issues to consider before deciding

whether to accept or reject it. In general the approach should be considered viable as long as the marginal benefit derived from its use exceeds the marginal costs of its implementation.

There are a number of characteristics inherent in an item that lend themselves towards the no support option. These include:

- Relative low cost. While an item may satisfy the MB = MC relationship criteria for throwaway at any cost level, in general this method is applied to less expensive items.
- Simplified fault detection and isolation. This implies some form of highly reliable unit self test capability. This is necessary to prevent the operator from discarding an item incorrectly diagnosed as having failed.
- Modular construction. Internal accessibility is usually limited since no maintenance is planned. [Ref. 14:p. 40]

a. Advantages

The obvious appeal of this method is the minimal requirement for any investment in logistics support. No lower level spares are required since the unit is intended to be discarded and replaced upon failure. Since maintenance actions will be limited to remove and replace functions, maintenance training and skill requirements are kept to an absolute minimum. [Ref. 15:p. 32]

Another significant appeal of this approach is the speed with which it allows a system to be placed in the hands of the operator. The acquisition system's only concern is

procuring sufficient quantities of the item. This feature is particularly attractive as the urgency of need for the item increases.

b. Disadvantages

Not providing support is potentially the most costly method of addressing logistics. Additionally, even if the approach makes fiscal sense, the perception of wastefulness on behalf of the government may be sufficient in today's budget conscious climate to render it infeasible.

There are several other pitfalls with this approach. The concept does not always lend itself equally well to both peacetime and wartime environments. [Ref. 14:p. 42] Additionally, since no repair is planned, critical items would require the maintenance of some inventory stock levels. Accurately determining that level may require a more detailed level of logistical analysis than the concept provides for.

2. Organic Support

Organic support requires the Government to assume complete responsibility for all facets of logistic support. This would include the development of allowance parts lists (APL's), technical manuals, maintenance and training plans. Clearly this is an expensive and time consuming process that requires careful consideration before being selected. This form of support is difficult to provide for items that are

required immediately and is better suited for items whose delivery to operational units is less urgent. Items chosen to receive this form of support are likely to share these common characteristics:

- System wide population. In order for this form of support to justify its large investment in time and resources, the item needs to be in general use across a range of activities. Long term requirement. Again, due to its expense, this is a form of support best suited for items that are anticipated to have a requirement for the foreseeable future.
- Availability of technical data. In order for this approach to be feasible the item's manufacturer must be both willing and able to provide the Government with a complete technical data package. This raises proprietary rights issues and almost certainly will involve additional expense on behalf of the Government. [Ref. 15: p. 35-37]

a. Advantages

In spite of high up front costs for facilities, infrastructure, repair capabilities and equipment, this method is potentially the least expensive and most effective method of support for nondevelopmental items with high failure rates and large populations. [Ref. 14 p. 45] The approach has the additional appeal of being better suited to a wartime environment because maintenance capabilities are able to be located as close to combat units as is required. [Ref. 15: p.38] Although many defense contractors performed admirably during the Gulf war, it is not practical to expect contract personnel to always be willing to operate in a combat zone.

b. Disadvantages

Organic support is extremely costly for nondevelopmental items that fail infrequently or are limited in their application. Developing it may require the government to obtain technical or proprietary data that the producer is either unwilling to part with or wants a prohibitively high price for. Furthermore, the item must have sufficient maintainability and reliability data available in order to design the support. This information is simply unavailable with many nondevelopmental items.

A final consideration is the time delay. If the item is withheld from the operator until complete organic support is designed and in place, then one of the primary advantages of nondevelopmental items, speed of introduction, is lost.

3. Total Contractor Support

TCS delegates responsibility for providing logistic support to the contractor. This may be done either overtly, by establishing a contractual obligation, or by default, if the system fails to provide other support options. The concept is quite simple. Upon failure, the item is returned to the contractor for restoration to working order. For a price the Government is relieved of the responsibility for developing a logistics support capability as well as maintaining the spare parts necessary to support that capability. Characteristics common to items best supported by this method include:

- Relatively high cost. The value of the item, its components or its salvage is great enough to justify the cost of providing an external support capability.
- Relatively low failure rate. The item must be reliable for this approach to work. Items that tend to fail frequently would be both costly and difficult to support by this method.
- Intended for use in a non-combat environment. Clearly the urgency of a combat environment would not lend itself well towards the time delay involved in packaging and transporting the item to the contractor.
- Comparatively high tech. If the item is in a rapidly developing field or the requirement is for state of the art capability, this may be the most effective option.
- Well established geographically diverse contractor. The Government needs to have reasonable assurance that the contractor will remain in business for the duration of the item and that it possesses the capability to provide support over a wide area. [Ref. 15: p. 34-35]

a. Advantages

The TCS approach attempts to combine the advantages of the no support method and the organic support method. Responsibility for failures and support is borne solely by the contractor allowing the government to direct logistic resources into more profitable venues. This method may be the best option in high technology areas where maintaining state of the art capability is critical. [Ref. 14:p. 44]

b. Disadvantages

Total contractor support is restricted in the range

of items it is suitable for, since its feasibility for items intended for use in a combat environment is limited. If the contractor is not located near the user, high transportation costs and delays in replenishment of failed items are possible.

The government must also recognize that they are in effect granting the contractor a monopoly on the repair business for the item. As such, the potential for excessive charges, poor quality work or simply inadequate support must be recognized. Additionally, should the contractor's business fail, the government may find itself with a large inventory of unsupported items.

4. Contractor And Organic Support Mix

The mix method seeks the best of both worlds. The concept is to capitalize on the strengths of both methods while avoiding the shortcomings of either. This is done by fashioning some form of shared responsibility for providing logistics support between the Government and the contractor. Presumably, the more of this burden the Government wishes to shift towards the contractor, the greater the cost of doing so will be.

The mix approach may be beneficial for items that, not surprisingly, fall into the middle ground in many of the previously discussed categories. Some examples of this would be:

- Mid to low range failure rate. The item fails often enough that some form of organic capability is justified, but not so frequently that full blown in house support is necessary.
- Mid-range technical complexity. The item is of such a nature that some form of organizational support is beneficial (i.e. lubrication, inspection) but overall the item is complex enough to make complete organic support undesirable.
- Mid-range cost. The item is too expensive to be not supported and not expensive enough to justify either complete organic or contractor support.
- Intended for use in both combat and non-combat environment. The item is intended for use in a range of different settings. [Ref. 15:p. 38-39]

a. Advantages

The mix approach allows the government to enjoy the benefits of the total contractor support method while moderating some of the potential disadvantages of that method. It allows the government the flexibility to utilize a phased support approach in which the support system is designed incrementally in response to the availability of maintenance assets. [Ref. 15:p. 39]

Another benefit to this method is that it allows a program opting for organic support to field the system immediately and use the contractor to provide support on an interim basis. This gives the government the time to develop its own support assets, or evaluate if it is cost effective to do so, while still realizing the benefit of placing the item in the hands of the operator as rapidly as possible.

b. Disadvantages

The mix approach can be costly if improperly implemented or carelessly administered. It can be difficult to control the transition from one method to the next. Failure to clearly delineate responsibilities, requirements and time frames for each party can result in costly delays and misunderstandings. The potential exists to be paying for two separate and distinct support systems neither of which is providing the level of benefit one would expect from a single "pure" approach. [Ref. 15:p. 39]

H. CHAPTER SUMMARY

Chapter II has laid the foundation for examining the research questions presented in Chapter I. It begins by defining what a nondevelopmental item is and giving some background on the movement to increase the use of nondevelopmental items in DOD acquisitions. It examines the advantages and disadvantages associated with nondevelopmental items and the differences in the acquisition process for developmental versus nondevelopmental items. It concludes by exploring the primary methods of supporting a nondevelopmental item and the relative strengths and weaknesses of each approach.

III. THE PORTABLE HYDRAULIC ACCESS RESCUE SYSTEM (PHARS)

A. INTRODUCTION

This chapter will define what the PHARS is and examine the history of the its acquisition. It will also serve to introduce, and provide a context for, the logistics issues to be explored in Chapter IV.

B. DEFINITION

The term PHARS is a generic one used to describe a portable hydraulic tool whose intended use involves cutting through, or punching holes in, sheet metal. The Navy's primary interest in the tool lies in it's potential for rescuing personnel trapped behind structural metal during damage control operations. Secondary features of interest to the Navy include the ability to make bulkhead penetrations or remove obstructions in order to allow either entry into a space or access for de-watering. Additional applications include use for assistance with cleanup and salvage. [Ref. 17]

C. HISTORY

For decades, commercial fire fighting and rescue departments have successfully employed PHARS type equipment to extricate victims of automobile accidents. Their utility has been recognized in other commercial and industrial applications such as channel dredging, salvage operations,

offshore drilling operations, oil refineries, shipyards and harbor terminals. [Ref. 17]

The roots of the Navy's acquisition of the PHARS lie in the 1987 disaster in which the USS Stark was struck by two Exocet misses fired by an Iraqi warplane. The resulting conflagration killed 37 U.S. servicemen and caused some \$45 million in damage to the Stark. The fire was so hot that the main deck and the starboard side of the ship glowed cherry red. Starks solid steel main deck was warped. Structural damage to the ship was enormous with mangled compartments and hatches melted shut by deckplate temperatures in excess of 1400 degrees Fahrenheit. The fires raged for three days and were fought by personnel from 5 ships who had rushed to the Stark's aid. [Ref. 18:p. 2-5]

During the prolonged fire fighting and damage control operations onboard Stark, the Navy learned of some critical equipment shortcomings. These deficiencies were summarized in a message composed by the USS Conyngham, one of the primary ships rendering assistance during the disaster. Prominent among them was a need for "emergency extrication equipment". They were identified as the result of a prescient commander who had actually fought the fire. He ordered those directly involved to sit down and "brain storm" about what went right, what went wrong and what additional equipment would have been valuable to them in their efforts to control the fire and save lives.

As a result of the Conyngham message on 19 Oct, 1987 the Naval Sea Systems Command (NAVSEA) Requested a total of \$64 million dollars from Congress. These funds were to be used to outfit the fleet with the items on the Conyngham list. Of this amount \$3 million was specifically earmarked for procurement of emergency extrication equipment.[Ref. 19]

D. THE INITIAL ATTEMPT AT AN ORGANIC SUPPORT BASED PROCUREMENT

NAVSEA immediately began efforts to produce a technical specification for the PHARS. Traditionally this specification is what the Navy's Ships Parts Control Center (SPCC) would use to produce a commercial item description (CID) in order to contract for the device. These specifications are also essential to the Naval Ships Systems Engineering Station (NAVSESS) and SPCC and in determining the types and quantities of equipment necessary to provide organic support for an item.[Ref. 20]

The actual process of creating the specification was, unfortunately, an extremely lengthy one. Fraught with bureaucratic infighting, personality conflicts and a contractual protest, it was not completed until September of 1991, over four years from the Stark tragedy.

Among the many factors contributing to the delay, two stand out. The first was a formal protest by the Hale Fire Pump Corporation. The company contended that the NAVSEA

specification called for "better than industry standards" and would necessitate extensive modifications of the supplier's production line. The company's position was and is that the Navy was attempting to obtain a defacto developmental item under the guise of a nondevelopmental procurement. Although the protest was eventually denied, it served to significantly extend and complicate the process. [Ref. 22]

The second delaying factor originated at SPCC. In August of 1990, NAVSEA provided SPCC with completed technical specification. SPCC immediately set to work to procure and provision the item. During this process however, one of the provisioners, an ex Damage Control Chief Petty Officer, noticed that the specification called for an electrically powered (440V) PHARS. Since the PHARS was intended to be used during damage control operations onboard ship when electrical power is frequently unavailable, he felt the specification was unrealistic. He raised the issue with his superiors, who after liaising with the Atlantic Fleet Nondevelopmental Item activity, concurred. They then recommended the specification be re-done calling instead for a diesel powered PHARS.

The net result of all this was to effectively freeze any movement towards introducing the PHARS to the fleet by traditional methods. It was also to have significant ramifications for the logistic support and configuration management of the item.

E. CONTRACTOR SUPPORTED TOOLS ARE INTRODUCED

In September of 1988 the Under Secretary of the Navy for Safety and Survivability, extremely frustrated by what he termed the "paralysis of analysis", took a highly unusual step. He personally authorized any command with procurement authority and available discretionary funds to buy the PHARS directly from the manufacturer. [Ref. 17] This was done largely as a function of the Under Secretary's perception that NAVSEA was making insufficient progress towards completing a specification which would allow SPCC to bid, purchase and provision the item. The Under Secretary's opinion in this matter is best expressed in his own words:

We had a tool with a proven track record of saving lives. We also had ships and sailors going in harms way without that tool. I couldn't have cared less about paperwork or logistics, my primary concern was to, as rapidly as possible, put that tool in the hands of the men likely to need it most. [Ref. 21]

To a large extent the Under Secretary achieved this goal by creating a system which gave the fleet operator not only the ability to buy the PHARS, but also legal justification for so doing. The authority was granted under an innovative document known as an Interim Qualification Requirement (IQR). The IQR was created by the Under Secretary's Contracting Officer, and based on testing done at the Atlantic Fleet Nondevelopmental Item Facility In Norfolk, Virginia.

The document certified that three companies, Hurst,

Holmatro and Phoenix as produced a tool that met the Navy's needs.[Ref.17] The logistics support philosophy was intended as total contractor support buttressed by a comprehensive one year "all parts and labor" warranty offered by each company.

In the time period between 1988 and 1991, over 300 PHARS devices were procured and delivered to the fleet under this approach. Some of these were bought by individual units using the Under Secretary's IQR and they were spread among the three companies listed therein. The majority, however, were bought with funds obtained by the Under Secretary's office and "pushed" (delivered without a requisition on behalf of the receiving activity) to the fleet. These consisted of approximately 75% of the total and were exclusively manufactured by Hurst.[Ref. 20]

The PHARS then entered the system with no provisioning or organic support from SPCC and without the benefit of detailed testing or a technical specification from NAVSEA. Precise information on which ships got which device, or even how many were delivered, individually or in total, was not kept. This oversight started a "logistics support nightmare" [Ref. 20] which continues to plague the program even today.

Needless to say, this action was cause for some consternation at both NAVSEA and SPCC. This was a significant, at the time almost a complete, departure from the traditional approach. Traditionally, some form of technical specification and at least some minimal Allowance Parts List (APL) support

was in place before an item with a system wide application was introduced.

NAVSEA's position on this approach was succinctly summarized in a letter from the Commander Naval Sea Systems Command as follows:

The burden of ensuring that the fleet receives equipment that meets its operational requirement, and the assumption of life cycle responsibility for that equipment rests upon NAVSEA not SECNAV, CINCLANTFLT-NDI or individual manufacturers. Controlled and documented tests are the only method by which NAVSEA can be expected to insure the adequacy of the equipment that it puts on fleet ships. [Ref. 23:p. 2]

SPCC's position on the matter was summed up in the words of the program manager for damage control items:

I had a real problem with a safety and survivability item being placed on ships with no organic support available. That may be fine as long as the ship stays pier-side, but what happens when the thing breaks and the ship is on the other side of the world? It's my job to make sure these things are properly supported and my phone is going to be the one ringing when people can't, or don't know how, to get spare parts. [Ref. 20]

In spite of these very real and vociferously expressed concerns, the PHARS, as a completely contractor supported device, continued to proliferate throughout the fleet. This was due in no small part to the increasing tensions in the Persian Gulf. The escalating crisis fostered an atmosphere of urgency that allowed the Under Secretary's "get the stuff out there, paperwork to follow" philosophy to prevail. At the same

time however, pressure from Congress and bureaucratic momentum also served to keep the procurement based on conventional support methods slowly moving forward.

By 1993, there existed in the fleet an unknown number of PHARS, produced by a variety of manufacturers. Concerns about maintainability and supportability led the program manager at SPCC to begin an extensive effort to reverse engineer organic logistics support for all the PHARS in the system. Until that time, the only support provided for these items was in the form of an instructional video, the manufacturer's warranty and manuals, and the expertise of the personnel at the Atlantic Fleet Nondevelopmental Item Facility.

F. AN ORGANICALLY SUPPORTED PHARS IS DELIVERED

A procurement under conventional methods was finally completed in July of 1993 when SPCC issued a contract to the Phoenix corporation to supply the Navy with 47 PHARS. [Ref. 24] It is noteworthy that this was accomplished fully six years after the Stark attack and over 5 years after the device was first introduced to the fleet.

This procurement was, for all practical purposes, the polar opposite of the previous buy(s). The support philosophy was 100% organic. This buy was the result of an exhaustive test and evaluation process and driven by an extremely comprehensive commercial item description. Engineers at NAVSEA and NAVSESS, as well as provisioning and contracting personnel

at SPCC, had spent years getting it right.

Included in the contract was the requirement for the company to provide the Navy with the provisioning technical documentation (PTD) that SPCC and NAVSESS would require in order to provide 100% organic support for the PHARS. This was a critical omission in the first buy(s). As provisioning personnel at SPCC tried to build support for the PHARS not obtained under this contract, they had to go, "hat in hand" to the manufacturers and ask for the data. This was an extremely tedious process since the companies in many instances viewed the data as proprietary and were under no contractual obligation to provide it. [Ref.20]

In order to complete the development of organic support, a national stock number (NSN) was assigned and an Allowance Parts List (APL), with all significant subcomponents broken out and stock numbered, was developed. A new and completely different maintenance philosophy existed. Instead of total contractor support the PHARS was classified as an organic repairable and slated for both organizational and intermediate level maintenance. A complete planned maintenance system (PMS) was created and delivered with the tool.

G. SUMMARY

This chapter covered what the PHARS is, its history and the roots of the Navy's interest in the device. It examined the nature of various procurements by SECNAV, CINCLANTFLT

Nondevelopmental Item Facility, NAVSEA and SPCC. It also delineated the difference in support, procurement and maintenance philosophy among these organizations.

IV. PHARS LOGISTICS SUPPORT ISSUES

A. INTRODUCTION

This chapter will lay the foundation for the cost benefit analysis to be conducted in Chapter V. It will do so by examining the logistics issues resulting from the conflicting procurement and support strategies. As part of this analysis failure data for the system, both predicted and observed, will be presented. Also included in the data will be the results of a fleet wide survey on the satisfaction with the types of the logistic support currently being provided the PHARS. [Appendix B] This survey was conducted among supply officers and damage control assistants on afloat units.

B. PHARS LOGISTICS ISSUES

As a result of the range of methods and support philosophies under which the PHARS was introduced to the fleet, there are a host of logistics challenges associated with the program. They may be grouped into five general categories:

- Allowance Part Lists (APL's) and Stock Numbering
- Planned Maintenance and Maintenance Requirements
- Technical Manuals
- Training
- Configuration Issues

1. APL Issues

An APL takes a major component and breaks it down into the subcomponents or piece parts it is composed of. It identifies each component and subcomponent either by NSN or part number. This information is essential to the fleet operator for performing both supply and maintenance functions. In essence, if any level of organic support is planned for the item, a complete and accurate APL is intrinsic to that process.

The PHARS system is made up of the following major components:

- Hydraulic power unit
- Engine Diesel
- Ram, Hydraulic
- Spreader, Hydraulic
- Cutter, Hydraulic
- Reel, Hose with Hose on Reel
- Hose, Hydraulic
- Manual, Technical
- Manifold, Multiple Connection
- Fluid, Hydraulic

a. *APL's And Stock Number Support*

In theory, to provide complete organic support, each one of these major components is, or should be, APL supported. As of September 1995 this action had only been completed for

the Phoenix tool acquired in the most recent SPCC Procurement.
[Ref. 25]

This means that ships with PHARS from Holmatro and Hurst, as well as ships holding Phoenix tools bought in the late 80's or very early 90's, do not have accurate and complete APL's. The result is a lack of specific information on what equipment they should be carrying and how they should go about obtaining it. Under the currently available APL, a ship attempting to organically support any PHARS other than the most recent Phoenix tool will find its storerooms stocked with equipment of limited utility at best.

This in turn tends to frustrate the very concept of organic support. If a fleet operator is unable to determine how to obtain repair parts from the supply system, or those parts don't match his needs, his options are to seek commercial support or discard the item. With approximately half the PHARS in the Navy inventory falling into this category this is a serious and ongoing problem.

For illustration purposes consider the APL for the diesel engine component on the Phoenix PHARS bought by SPCC in 1993. It is two pages long and lists 51 subcomponents. A ship with one PHARS assigned would be required to carry 29 of these subcomponents in onboard inventory. The value of these carried subcomponents, based on a check of stock system prices as of 18 Jan, 1996 is \$391.00. Extrapolating out over nine other primary components, three separate configurations and three

hundred ships, gives one an idea of the scope of the issue.

NAVSEA has taken steps to address the problem by contracting with NAVSESS in an attempt to create a generic "parent" APL. The purpose of the parent APL will be to cover the tools from all three manufacturers under one APL "family" and hopefully simplify ordering and maintenance procedures. To date, over \$50,000.00 has been invested in this endeavor. The work is ongoing and no completion date has been established. [Ref. 26]

Closely related to the problems associated with the APLs is the generic NSN issue. SPCC currently uses a generic NSN (4240-01-279-8598) for the PHARS systems. Units ordering a PHARS under this stock number can receive any of the three different tools. This has two distinct effects. First it tends to speed the requisitioning process as orders are able to be filled by whichever tool is in stock or can most rapidly be procured. This speed, however, is bought at the price of the second effect, a short circuit of the organic support concept. An examination of the history of this practice shows that PHARS of various manufacturers are being reported as delivered to the same ship. [Ref. 27] This introduces the problem of mixing components between systems as well as potentially forcing the ship to bear the cost of supporting completely different versions of the same tool.

2. Planned Maintenance And Maintenance Requirements Issues

The current commercial maintenance philosophy for the PHARS requires routine cleaning, checking fluid levels and visual inspection of components for wear and damage. Most component repair is limited to the replacement of worn or broken tool accessories and parts. Currently, damaged hoses, fittings, pumps and engines are repaired by a nationwide network of authorized dealers. In the course of this research the author had cause to contact a wide range of dealers representing each of the three manufacturers. Without exception they provided prompt, knowledgeable and courteous service.

Concerns over support for deployed units has led the Navy to attempt to replicate the commercial maintenance philosophy on an organic basis. Shipboard or organizational maintenance is intended to be similar to existing commercial practices. Major repair is slated for accomplishment at an intermediate level onboard a Tender or at a Shore Intermediate Maintenance Activity (SIMA). [Ref. 20]

The Navy supports its equipment at the shipboard level under the planned maintenance system (PMS) philosophy. Under this system equipments are subject to maintenance and inspection checks of varying degrees at specified intervals. The individual performing the maintenance is required to perform the maintenance while in possession of a Maintenance

Requirements Card (MRC). The card describes in exhaustive detail just how the check is to be performed and what materials are required to be used in performing the check.

a. Incomplete PMS

The use of three different vendors for the PHARS has produced a range of tools each with unique maintenance needs. To date, only the Phoenix tool has a complete and comprehensive organic PMS package. The other maintenance packages are in varying states of development and are yet to be delivered.

[Ref. 26]

b. Incomplete Maintenance Requirements Cards

Currently, MRC's are not available for all existing PHARS. Those that do exist are inaccurate and unclear as to differences between units. [Ref. 28] The fact that ships are unclear as to the maintenance requirements is evident. In 1995 decommissioning units turned 35 units into the CINCLANTFLT Nondevelopmental Item Facility. Of the returned units, 30 (85.7%) required major repair, directly related to PMS being performed incorrectly or not at all. [Ref. 28]

c. Hydraulic Fluids

Another significant maintenance issue plaguing the PHARS program is hydraulic fluids. Presently each of the three

tools requires a different type of fluid:

- Hurst / Hale uses phosphate ester Mil-H-19457
- Holmatro uses a synthetic hydrocarbon Mil-H-83282
- Phoenix uses Diethylene Glycol Mil-H-22072

The fluids are not interchangeable and mixing of the fluids results in potentially significant damage to the device. At best, the hydraulic lines will simply clog and render the PHARS inoperative but repairable. At worst, rusting and pitting of major components has been observed, damaging the tool beyond repair. [Ref. 28]

It is unfortunate that the Navy finds itself in this position at all. A December 1988 report by the Naval Ship System Engineering Station (NAVSESS) "strongly recommended" that Phosphate ester be specified as the sole acceptable hydraulic fluid. [Ref. 27:p. 12] This report notwithstanding, the Commercial Item Description issued by SPCC in July of 1993 cites three different hydraulic fluids as acceptable. [Ref. 30:p. 2] As fate would have it, each of the three manufacturers has opted to select a different fluid.

d. Hydraulic Hoses

Perhaps the most well publicized maintenance issue currently facing the PHARS centers around the hydraulic hoses employed by the Phoenix companies tool. These hoses have been repeatedly reported by fleet units as having ruptured during

operation. There has been a documented instance where a hydraulic hose burst during operation and sprayed the operator in the eyes with hydraulic fluid. Clearly, the rupturing hoses pose a threat to personnel safety and impact overall operation and maintenance of the device. [Ref. 31]

The cause of the problem is the source of some debate. One school of thought holds that the problem lies in the companies own test procedures. While Hurst and Holmatro both test their hoses at a specification calling for failure at over 20,000 lbs Per square inch (PSI), the Phoenix spec only calls for 7500 lbs PSI. No hoses on any tool other than the Phoenix have been reported as failing.

Phoenix's position is that the failures were caused by faulty hoses supplied to it by one of its subcontractors and has since changed suppliers. Naval Surface Warfare Center, Philadelphia Pa., continues to investigate the failures and has yet to identify a specific cause.

Further exacerbating the issue is that no replacement hoses are available through the Navy supply system. Lack of organic parts support will almost certainly force operators to seek commercially available replacements. A random check of three authorized dealers in California on 23 January, 1996, showed all three to have the hose in stock and ready for immediate shipment.

e. Technical Manuals

The Phoenix system is the only one of the three tools to have a completed technical manual, written to Navy standards. The manual is stock numbered and available at no cost under NSN 0910-LP-572-2100. The other manuals are written to commercial specifications, are not standardized, and are not presented in any format familiar to the shipboard operator.

Resolving this issue will be time consuming and costly since much of the material required to produce a tech manual to Navy standards is considered proprietary by the industry. Hurst and Holmatro are under absolutely no contractual obligation to provide the Navy with this information. As such, they can set their own price or simply refuse to provide the data. [Ref. 20]

3. Training

In any damage control scenario the key to how well an individual or a ship performs lies in the level of training. The mantra throughout the fleet and in the damage control schools is that in a crisis "training takes over." The issue for the PHARS is that each unit is connected and used differently. In the event of an actual emergency, precious minutes could be lost due to confusion over the operation of differing tools.

Attempting to organically support three different tools

will require fleet personnel to be familiar with the operation of all three. This in turn will require training commands to teach all three. In order to do this each training command must possess one of each of the units.

a. *School House Training*

PHARS use is currently taught in the General Damage Control Shipboard class (course #045) and the General Damage Control Team Training class (course #046). Students are given the opportunity to see the tool, put it together, start it and run it as a demo. Unfortunately, The schools currently possess only the Hurst tool and as such, it is the only tool that fleet personnel are receiving formalized hands on training with. No testing has been done to determine how each manufacturers equipment performs against similar damage.

b. *Damage Control Layout Booklet*

The intent of this book is to provide the fleet operator with a specific illustration of how and under what circumstances the various equipment in his damage control arsenal may be used. The book possesses sketches on general usage of the PHARS but does not address the different techniques required for the use of different tools. For complete organic support the book will need to be updated to address the differences between tools.

4. Configuration Issues

Configuration management is the system by which a product's planned and changing configurations are accurately identified, and for which control and accountability of change are maintained. [Ref. 32:p. 228] Lack of standardization and shoddy records keeping are at the heart of the configuration issues faced by the PHARS program today.

a. Lack Of Standardization

Configuration challenges are inherent to most nondevelopmental item procurements. Since the government exercises no control over the production or design phases, the manufacturer is free to make changes or substitutions to any component they desire. This issue is compounded in the case of the PHARS by the fact that the Navy is using tools from three different manufacturers. Each tool possesses a different design, different capabilities and different operating characteristics.

b. Unknown Types And Quantities

Imagine hosting a dinner party upon whose success lives could literally depend. Imagine also that you don't know how many people are coming, their tastes or dietary requirements. It is in a similar situation that the life cycle manager for the PHARS finds himself. His dilemma is caused by the fact that a complete and accurate list of quantities and

types of PHARS does not currently exist in the fleet. [Ref. 20]

The lack of information on units in fleet possession is attributable to the rush to place some form of PHARS capability on ships deploying to the Persian Gulf during Desert Storm / Desert Shield. Incomplete records were kept of ships procuring PHARS under the Interim Qualification Requirement provided by Under Secretary Taussig's office. Additionally, the CINCLANTFLT Nondevelopmental Item Facility has only fragmentary information on the number and type of PHARS it procured for shipboard use in the period 1988-1991.

Current best estimates place the number of PHARS possessed by the fleet at 380-400. [Ref. 32]The distribution of PHARS procured under contract by SPCC is known to be:

- Hale 126 units [Ref. 33]
- Holmatro 66 units [Ref. 34]
- Phoenix 153 units [Ref. 35]

This translates into between nine and fourteen percent of the PHARS in the fleet as being of unknown origin and therefore virtually unsupportable by organic means.

C. FAILURE DATA

Based on information provided by all three participating manufacturers and corroborated by NAVSESS, the projected serviceable life of the PHARS is 500 hours. [Ref. 27:p. 12]

Based on recurring demand, data provided by the PHARS program manager at SPCC shows the actual system wide failure rate is one unit per quarter or 4 per year. [Ref. 20]

D. SURVEY RESULTS

300 surveys were mailed to afloat units. The survey asked the Supply Officer and Damage Control Assistant to answer both qualitative and quantitative questions with respect to logistics support for the PHARS. The fleet returned 44 surveys for a response rate of 14.67%. The results are summarized in the following table:

PHARS LOGISTICS SUPPORT				
	Phoenix	Hurst	Holmatro	Totals
Type of PHARS Held Onboard	21	18	5	44
# That Are APL Supported	21	0	0	21
Availability of Repair parts	Sat (18) Unsat (3)	Sat (16) Unsat (2)	Sat (5) Unsat (0)	Sat (39) Unsat (5)
Method for Meeting Parts Demand	Organic (17) Comm. (4)	Organic (2) Comm (16)	Organic (1) Comm (4)	Organic (20) Comm (24)
Adequately Trained Operator Onbd	10	9	2	21
Satisfactory Navy Standard Tech Manual Onboard	11	0	0	11
Satisfactory Comm Standard Tech Manual Onboard	1	9	3	14
Adequate Maintenance Plan In Place	16	13	3	32
Satisfaction With Overall Level of Support	Sat (15) Unsat (8)	Sat (13) Unsat (5)	Sat (4) Unsat (1)	Sat (32) Unsat (14)

Table No. 1 Survey Results

E. INTERPRETATION OF SURVEY RESULTS

The results of the survey came as somewhat of a surprise. The author had hypothesized that units possessing PHARS lacking complete organic support would be less satisfied with their support structure. Instead, the survey results indicated in the large majority of categories measured, that units with commercially supported PHARS had an equivalent or higher degree of satisfaction with their method of logistics support. The following table summarizes the survey data with respect to satisfaction levels for commercially vice organically supported tools.

Percentage Breakdown of Operator Reported Satisfaction for Alternative Support Methods			
	Commercial	Organic	Preferred
Availability of Repair Parts	16/18 = 91.3%	18/21 = 85.7%	Commercial
Adequately Trained Operator Onboard	11/23 = 47.8%	10/21 = 47.6%	Commercial
Satisfactory Tech Manual Onboard	13/23 = 56.5%	12/21 = 52.3%	Commercial
Adequate Maintenance Plan in Place	16/21 = 76.2%	16/23 = 69.6%	Organic
Satisfied with Overall level of Support	15/21 = 71.4%	17/23 = 73.9%	Commercial

Table No. 2 Satisfaction Levels

As illustrated above the fleet operator has expressed preference for commercial vice organic support in four of the five categories measured. Although in many cases the degree of preference expressed is quite small it is a critical distinction. Its significance lies in the fact that the Navy is currently expending a great deal of time and money to switch the support philosophy to a method deemed less satisfactory by the end user.

F. SUMMARY

This chapter examined the logistics issues surrounding the PHARS program. It presented data on support, maintenance, training and failure rates for the item. The chapter concludes with a survey which uses both qualitative and quantitative measures to gauge fleet perception of current levels of logistic support.

V. COST BENEFIT ANALYSIS

A. INTRODUCTION

This chapter will present an analysis of the cost effectiveness of the current logistic support philosophy for the PHARS. For the purpose of this analysis cost effectiveness will be related to the measure of the PHARS performance as a function of the type of logistics support provided. The PHARS performance will be defined in terms of its ability to complete its mission as expressed by those actually operating the system.

B. DEFINITION OF THE PROBLEM

Three different models of the PHARS were originally introduced to the fleet under a philosophy of 100% contractor support. That philosophy was subsequently modified to be 100% organic support. To date, only one of the three systems has achieved complete organic support. Based on Survey data collected from actual fleet operators, satisfaction with logistic support is slightly lower for the organically supported model. This analysis will examine the cost savings available from continuing with 100% contractor support for the remaining two systems.

C. ANALYSIS ASSUMPTIONS

A number of assumptions are made in deriving logistic support costs for the PHARS. The first assumption, that cost estimates are for afloat units only, as opposed to both afloat units and shore sites, was made in order to scope the study into manageable parameters. It is expected that it will be possible to extrapolate the results to include shore based inventory costs as well.

The study also includes the following qualitative assumptions:

- That effective support is best defined by the end user of the item.
- That there is a cost associated with delaying deployment of an item with a proven safety and survivability application.
- That Naval personnel are as capable of reading and following instructions in a manufacturer's manual as their civilian counterparts.

Quantitative assumptions:

- A 300 ship Navy.
- A Fleet-wide population of 390 PHARS.
- A distribution roughly equal to 40% organically supported, 60% commercially supported.
- A life cycle of 10 years for the system.
- A discount rate of 5.7%. [Ref. 36 Appendix C]

- A cost to produce a technical manual of \$250 per page. [Ref.26]
- An average inventory of 85 line items with a value of \$1300.00 (rounded) required to support one PHARS at the shipboard level.
- Sunk costs will be ignored.

D. PHARS LIFE CYCLE QUANTITATIVE COST ELEMENTS

The following Quantitative lifecycle and support cost elements will be examined:

- Cost of APL Support.
- Cost of Navy Technical Manual.
- Cost of Training.
- Cost of developing PMS.

1. Cost Of APL Support

There are two significant costs the Navy will incur by providing APL support for the two commercially supported PHARS. They are:

- Cost of shipboard inventory.
- Cost of developing two additional and separate APL's.

The cost of maintaining an APL driven shipboard inventory is computed as follows (Assumes equivalent range and depth of repair parts for all three tools):

$\$1300.00$ (cost of support) \times 390 (number of items) \times .6
(Percentage of items not APL Supported) = $\$304,200.00$.

The second cost incurred as a result of providing organic support is the cost of developing the APL. Based on a cost of $\$9000.00$ to develop the APL for the Phoenix tool [Ref.36], the cost to create a complete APL for the Hurst and Holmatro tools would be:

$\$9000 \times 2 = \$18,000.00$.

The benefit sacrificed by avoiding these costs is the instant availability of repair parts for the item. This sacrifice is mitigated by the extremely low failure rate of the item as discussed in chapter IV. Additional mitigating factors include the world wide network of dealers and the demonstrated ability of a number of air delivery services to provide overnight delivery.

2. Cost Of Navy Technical Manuals

There are two issues involved in providing tech manual support for the PHARS. One issue is qualitative and one quantitative. This section will examine the quantitative issue.

The current cost to produce a technical manual to Navy standards is approximately $\$250.00$ per page. [Ref. 26] The Navy standard tech manual provided for the Phoenix tool is 139

pages long. The Cost to produce Phoenix tech manual was:

$$139 \times \$250.00 = \$34,750$$

The cost for producing manuals for the Hurst and Holmatro tool would then be given as:

$$\$250.00 \times 139 \times 2 = \$69,500.00$$

The benefit sacrificed in order to obtain these savings is the capability to provide Naval maintenance personnel with detailed technical information, presented in a format they are familiar with. The loss of this benefit must be evaluated in terms of the intended maintenance philosophy. Clearly, the benefit received is directly related to the amount and level of intended organizational maintenance. Moderating the loss of this benefit is the fact that both commercially supported models come equipped with the manufacturer's use and maintenance manual. Survey data indicates that 52% of the operators of the commercially supported tool are satisfied with their manuals. The organically supported manual was only received slightly more favorably with 57% of the operators reporting satisfaction.

3. Cost Of Training

There are three costs associated with providing organic training for the PHARS. The first, and largest, is the cost of developing and producing the training approach itself. This cost can be broken into two categories: curriculum development

and generating instructor manuals. This task is normally given to a contractor specializing in training. For an item of the complexity and range of application of the PHARS, this cost is estimated to be in the range of \$50,000.00 [Ref. 37]

Since each of the three tools currently in the Navy inventory is connected and used differently, a unique curriculum and instructor's manual will be necessary for each tool. Total cost to produce training curriculum and instructors manuals:

$$2 \times \$50,000.00 = \$100,000.00$$

The second cost associated with training is the hourly wage rate of the personnel who are providing the training. This cost is variable since it is dependent upon the rank of the individual assigned. Instructors at both the Basic Shipboard Damage Control and Firefighting School, as well as the Damage Control Team Trainer School, are typically Chief Petty Officers. An hourly wage rate for those individuals is provided in the table below:

Instructor Wage Rates			
	E-9	E-8	E-7
Rate	\$32.65	\$25.91	\$23.91

Table No. 3 Instructor Wage Rates [Ref. 38]

The courses are taught in both Norfolk and San Diego.

Taking an average of the instructor wage rates, and assuming that each course would be presented six times a year with the PHARS covered for a two hour period, the additional cost of providing training for all three PHARS would be:

$\$27.49 \text{ (wages)} \times 24 \text{ (courses)} \times 2 \text{ (tools)} = \$1319.52 \text{ per year.}$

The final costs to consider with regard to training is the cost of providing the tools themselves to the training commands. The current average cost of a PHARS system to the Navy is \$10,000.00.[Ref. 26] Costs for providing all three tools to each command would be:

$\$10,000.00 \times 2 \text{ (commands)} \times 4 \text{ (tools)} = \$80,000.00$

The benefit sacrificed in order to obtain these savings would be the loss of standardization of operating skills. Although hardly trivial this loss must be viewed from the perspective that the Navy's decision to support three unique models of the PHARS renders virtually any standardization issue moot. Additionally each manufacturer does provide a training video on the start up and operation of their tool.

4. Cost Of Developing PMS

The cost of developing a planned maintenance system for the Phoenix system was \$4,250.00 [Ref. 36] The cost to develop an equivalent system for the other two tools would be:

2 x \$4,250.00 = \$8,500.00 in potential savings.

The benefit sacrificed in order to obtain this cost savings would be the lack of an exacting, highly standardized and scheduled preventative maintenance program. As addressed in chapter three, this area appears to be a problematic one and given the relatively low cost of implementation, the Navy may wish to absorb this cost.

E. PHARS LIFE CYCLE QUALITATIVE COST ELEMENTS

1. Costs Of Delaying Deployment

An important consideration when evaluating the costs of logistic support for the PHARS must be the opportunity cost of delaying deployment in order to build organic support. The first organically supported PHARS did not reach the fleet until almost seven years after the initial requirement was identified. In contrast commercially supported PHARS were placed on ships within 11 months after identifying the requirement. Had the decision been made to wait for complete organic support, the Navy would have had to forgo the benefit of having the item aboard ship for a period of seven years.

This foregone benefit, especially when dealing with items involving damage control or safety and survivability, is far from trivial. Data from the Safety and Survivability Office in Washington D.C. on two recent nondevelopmental item

procurements serves to reinforce this point.

In July of 1986, Vice admiral J.B. Wilkinson, Commander Naval Air Systems Command (NAVAIR), identified by letter the urgent need for a commercially available Helicopter Emergency Egress Device System (HEEDS). The HEEDS provides an emergency air supply to a pilot or crew member trapped in a sinking aircraft. The first deliveries to the fleet of this item took place in October of the same year. In the next three years of its use the HEEDS bottle was directly credited with saving 17 lives. [Ref. 39]

In February 1991, the USS Tripoli struck a mine while conducting mine counter measure operations off the coast of Kuwait. She carried with her a commercially supported nondevelopmental item for use in ventilation and de-smoking known as a RAM fan. The RAM fan was onboard to meet a user defined requirement. It had been placed onboard in less than two months as the result of a phone call between the ships C.O. and the Safety and Survivability Office. After the blast, the Commanding Officer of the Tripoli wrote letters to both the Safety and Survivability Office and the Ram fan manufacturer. In them he expressed his conviction that the device was superior to his organically supported fans and that it played a significant role in saving his ship. [Ref. 40]

Neither of these items was or is organically supported.

Both items, as a result of the urgency of need associated with their application, were placed in the fleet quickly without going through the wickets required for full organic support. Had either of these programs been slated for organic support and endured a lag from requirements identification to fleet introduction like the PHARS, the cost to the Navy would have been substantial.

2. Availability Of Data

This issue centers on the availability of the information required to produce technical manuals for the two commercially supported PHARS. This information is critical to developing any form of organic support. As stated earlier, much of this material is proprietary and generally contracted and paid for as a deliverable at the time of the initial buy. This was not done in the case of the Hurst and Holmatro tools. Neither company is under any obligation to provide this information to the Navy. If and when they are willing to make the data available, they will most certainly require compensation. To date no negotiations over the price of this material have taken place.

The cost the Navy bears in attempting to obtain this benefit includes more than just the price of the material. It also must assume the risk that the manufacturer will either

not provide the material or will demand an exorbitant price for it.

F. TOTAL COST OF PROVIDING 100% ORGANIC SUPPORT OVER A TEN YEAR LIFE CYCLE

The total additional costs incurred by the Navy in order to provide complete organic support over the life cycle of the PHARS are then computed as follows.

\$304,200.00	(Additional inventory)
\$ 18,000.00	(APL development)
\$ 69,500.00	(Technical manual development)
\$100,000.00	(Training curriculum and manual development)
\$ 1,320.00	(Annually recurring instructor wages)
\$ 80,000.00	(Additional PHARS required for training use)
+ \$ 8,500.00	(PMS development)
= \$581,520.00	(Total first year costs)
+ \$ 1,320.00	(Recurring salary expense, over a 9 year period and assuming a discount rate of 5.7%.)
= \$1,140,287.00	(Total additional cost of organic support throughout ten year life cycle of the PHARS.)

G. SUMMARY

This chapter has conducted a cost benefit analysis on the decision to provide 100% organic support for the PHARS. The criteria examined included costs for APL support, training, maintenance planning and technical documentation. It demonstrated an increase in life cycle costs of \$1,140,287.00 as a result of the decision to provide 100% organic support for all three models of the PHARS.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This thesis focused on the history of the PHARS procurement as a means of addressing logistic support issues for nondevelopmental items. It examined alternative logistic support strategies and conducted a fleet wide survey on the degree of satisfaction with the level and type of logistic support currently being provided the PHARS. A cost benefit analysis was performed on the current strategy. This analysis may have value to future program managers in assisting their decision on types and levels of support to be provided other nondevelopmental items. Based on survey response, the existing logistics support for the PHARS appears to be satisfactory. However, several areas were identified where improvements in both efficiency and effectiveness are possible.

B. CONCLUSIONS

1. There Is A More Cost Effective Way To Support The PHARS.

The current philosophy of 100% organic support is not economically justified. Survey respondents actually rated their satisfaction with logistic support higher for the commercially supported tool. Results from the cost benefit

analysis indicate that the Navy will spend in excess of \$1,000,000.00 over the next ten years to provide complete organic support for the PHARS. These funds will be spent to provide a method and level of support that the end user of the item deems less satisfactory than what already is in place.

2. The PHARS Is Best Supported By A Contractor Organic Mix.

As a function of its system wide application, low failure rate, high urgency of need, mid range cost and well established geographically diverse contractor the PHARS would best be supported by a mix of contractor and organic based support.

a. Contractor Elements

A number of factors combine to encourage the use of a mixed support method for the PHARS. Chief among them is the urgency associated with the initial procurement. Short term, need it now, nondevelopmental item procurements tend to preclude organic support, at least in the early stages of a system's life. The rush to field the system simply does not allow sufficient time for the development of an organic support capability. This does not mean that some form of organic support may not eventually be appropriate, but that the initial form of support should be from the contractor.

The next factor influencing the support choice is the durability of the item. As stated in chapter four, the projected operating life for the PHARS is five hundred hours. This translates into an annual system wide failure rate in the range of one in one hundred. The PHARS' long operating life is further extended by a limited range of use. Since it is primarily intended for use in emergency situations, it is not operated with great frequency. The low failure rate and limited use requirement makes full organic support costly and unnecessary.

Support by a world-wide network of authorized dealers provides additional reinforcement for a mixed support method. Survey data would seem to suggest that the dealer network and existing air freight capabilities make it easier and faster to obtain parts support commercially.

The final factor supporting the contractor side of a mixed support philosophy is the lack of standardization. By making the decision to accept three distinct and separate models into inventory, the Navy weighted the deck in favor of some form of contractor support. Retro fitting the entire program with organic support has been demonstrated to be a costly and time consuming affair. On a strict cost effectiveness based criteria, commercial support would seem to be the best of these options.

Cost effectiveness, however, should not be the sole basis for selection of a support method. Marginal benefit and best value must also be considered. Experience and research has shown that there are some PHARS logistic support functions best provided organically.

b. Organic Elements

As discussed in Chapter IV, basic maintenance requirements are either not understood, not being performed correctly, or simply not being done. This is resulting in shortened life cycles and tools that may not be functional when needed. An explanation for this may be found in the demands of shipboard life. There are already an enormous number of systems with maintenance actions scheduled and required. Given this, it is easy to see how a system not covered by organic PMS could be continuously deferred in the maintenance queue. Fortunately, as shown in Chapter V, the cost to develop an organic PMS package for the PHARS is relatively low and would add little to the life cycle cost. Indeed, by extending the life of the item and improving system readiness, an organic PMS package may actually pay for itself by lowering life cycle costs.

Training is another area that may best be served by an organic approach. It seems reasonable that if a system is

worth having, then it's worth providing its operators with a common basis for understanding the requirements and range of its applications. While it is true that each manufacturer provides an instructional video with their tool, the videos are tailored to civilian uses. The manufacturers provide no information on Navy specific applications.

Given the high costs associated with an organic training capability, the Navy may wish to explore some creative options for training on the PHARS. One option currently being explored by the life cycle manager is to create a Navy specific video. The video would use all three tools and demonstrate standard operating procedure for each. Its intent would be to provide some of the benefits of organic training while avoiding most of the costs.

3. Lack Of Standardization Significantly Impacted Efficiency.

The use of three separate manufacturers as supplier of the PHARS made logistics support exponentially more difficult. Each tool is connected, configured and used differently. This impacts the entire logistics spectrum from training, to maintenance, to parts support. The additional ownership costs incurred as a result of this practice were not considered.

4. The Shift In Support Philosophy Resulted In A Structural Mis-Alignment

The rush to deploy the system in response to an operational requirement resulted in a default philosophy of contractor support. This philosophy was able to accommodate a diversity of tools and manufacturers. An entire population of tools was introduced to the fleet premised on this method of support.

When the decision was made to switch from commercial to organic support, a rift in the logistics support structure occurred. Organic support is, by its nature, ill suited to varying configurations and operating requirements. The decision to shift forced the support establishment to attempt to support the item in an inverse fashion from that which it was accustomed to. The resulting poor fit between the procurement strategy and the support philosophy decreased the effectiveness of the support while increasing its cost.

5. It Should Be Possible To Extrapolate The Lessons Learned From The PHARS Procurement To Other Similar Nondevelopmental Items.

Nondevelopmental items bearing similar characteristics to the PHARS should be considered candidates for partial or complete contractor support. These characteristics should include: high urgency of need, durability, a proven technology and a well established and geographically diverse contractor.

C. RECOMMENDATIONS

As a result of this research the following recommendations are presented:

1. Programs Using Nondevelopmental Items Should Identify A Support Strategy Early And Remain Consistent With It.

The cost effectiveness of logistic support will be closely tied to the timing and consistency of the support strategy. This is particularly true for nondevelopmental items due to the rapidity with which they may be fielded. Failure to select a strategy early, and remain consistent with that strategy throughout the program, will almost certainly increase the costs and decrease the effectiveness of the support.

2. DOD Should Establish A Repository of Lessons Learned on the Effectiveness of Nondevelopmental Item Support Strategies.

There currently exists no central data base that evaluates the performance of nondevelopmental item support strategies. Valuable data on pitfalls to avoid and opportunities to exploit is being lost. A program manager opting for nondevelopmental items has no formalized method of benefitting from those who have gone before him. Navy program managers are unable to learn from their Army counterparts and

vice versa. As cost factors continue to motivate joint procurement efforts, the need for a mechanism to enable system integration will only increase.

3. Program Managers Must Ensure That Their Procurement Strategy Is In Synch With Their Support Philosophy.

In order to maximize the benefits inherent in a nondevelopmental item acquisition the procurement strategy and support philosophy must be on the same page. The benefits of speed to field, state of the art equipment and lower life cycle costs can be erased by a mis-aligned support philosophy. If the intent of the procurement is to rush an item into operation it is clearly best supported by the contractor.

4. Programs Using Nondevelopmental Items Should Carefully Select A Single Dedicated Contractor.

Careful selection of a single dedicated contractor can simplify logistic support issues for programs using nondevelopmental items. Potential problem areas such as interoperability, inter-changeability, and configuration control are either eradicated or greatly reduced. The Navy's use of three contractors for the PHARS program, and the subsequent deluge of logistics issues, serves to illustrate this point.

5. A Program Should Speak With One Voice.

"Too many cooks spoil the soup" is a truism which also applies to nondevelopmental item procurements. At various stages of the PHARS life cycle, decisions and actions by SECNAV, CINCLANTFLT, SPCC, NAVSEA and all three contractors played a major and often conflicting role in the program's development. One office, preferably that of the program manager, needs to be recognized by all parties involved as the focal point for decision making.

D. AREAS FOR FURTHER STUDY

- Examine the effect of statutory and regulatory competition requirements on the standardization and cost effectiveness of nondevelopmental item procurements.
- Develop a series of case studies on the cost effectiveness of varying forms of logistic support for nondevelopmental items.
- Examine nondevelopmental item support practices used by other nations.
- Assess the progress made by the DOD acquisition community in supporting statutory preference for nondevelopmental items.

APPENDIX A: ABBREVIATIONS AND ACRONYMS

APL	Allowance Parts List
CINCLANTFLT	Commander In Chief Atlantic Fleet
DCA	Damage Control Assistant
DOD	Department of Defense
DODI	Department of Defense Instruction
HEEDS	Helicopter emergency Egress Device
IQR	Interim Qualification Requirement
MB	Marginal Benefit
MC	Marginal Cost
MILSPEC	Military Specification
MILSTD	Military Standard
MNS	Mission Need Statement
MRC	Maintenance Requirements Card
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVSSSES	Naval Ships Systems Engineering Station
NAVICP	Naval Inventory Control Point
NDI	Nondevelopmental Item
NSN	National Stock Number
PHARS	Portable Hydraulic Access Rescue System
PMS	Preventitive Maintenance System
PSI	Per Square inch

PTD

Provisioning Technical Documentation

SECNAV

Secretary Of the Navy

APPENDIX B: SURVEY QUESTIONS

For Supply Officer

1. Do you currently have (circle one) NSN 4240-01-376-3727, 4240-01-331-6853 or 4240-01-279-8596 onboard?
2. If yes, do you have APL support for this item?
3. Would you judge availability of repair parts to be:
 - a. Sat
 - b. Unsat
4. How are you most frequently meeting demand for repair parts?
 - a. Organically
 - b. Commercially
5. Based on your experience has the support for this item been:
 - a. Sat
 - b. Unsat

For DCA

6. Do you have a technical manual on board?
7. If yes does it meet your needs?
8. Is your technical manual Navy standard or commercial in origin ?
9. Do you currently have onboard an operator who has received satisfactory training in the use of the PHARS?

10. Is there a satisfactory maintenance plan available for the PHARS?

a. Yes

b. No

11. Based on your experience has the support for this item been:

a. Sat

b. Unsat

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